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EFFECT OF SEAWEED LIQUID FERTILIZERS ON GERMINATION AND MORPHOLOGICAL PARAMETERS OF TRITICUM AESTIVUM LINN

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ABSTRACT

In the present piece of research work, the effect of SLF prepared with macroalgae *Cladophora* and *Gracilaria* spp was studied on *Triticum aestivum* Linn. in two sets of experiment- 1. Seventy two hrs after germination in petriplates; 2. Eight days after sowing in the plastic pots containing garden soil. Seeds of *Triticum aestivum* were soaked in 5%, 10%, and 15% SLF solutions and control for duration of 12 hours. Seed germination index, average number of roots, average length of roots and shoots were the parameters recorded in young seedlings post 72 hrs germination. Germination index was 100% in 5% *Cladophora* and in all strength of *Gracilaria* as against only 70% in control. Average root and shoot length of 72 hours old seedlings were recorded to be higher in 5% *Gracilaria* SLF followed by 10% *Cladophora* SLF treatment. In another set of experiment, germination index, average root and shoot length, fresh weight and total chlorophyll were studied in 8 days old seedlings that were cultivated in pots. Comparative analysis indicated that treatment with 5% *Gracilaria* SLF had a promoting effect on these parameters followed by 5% *Cladophora* SLF treatment. It is concluded that Seaweed liquid fertilizer of 10% *Gracilaria* has potential as a biostimulant in early growth of *Triticum aestivum*.

KEY WORDS: *Cladophora*, *Gracilaria*, SLF, Germination index.

INTRODUCTION:

Seaweed liquid fertilizers (SLF) are the liquid extracts of marine macroalgae that can be used in various dilutions to promote the germination index, growth, biochemical constituents and overall yield of plants. They are also known to provide resistance towards frost, and infection by fungus and insects (Abetz, 1980). Treatment with SLF has an ameliorating effect on seeds under salt stress conditions. They are considered to be one of the most ecologically safe organic fertilizers since they are of biological origin, biodegradable, non-polluting, harmless and safe for cattle and human beings (Zodape, 2000). SLF prepared from a large number of macro algae such as *Ulva lactuca*, *Unlva rigida, Ulva reticulate, Ulva fasciata*, *Gracilaria corticata*, *Fucus spiralis* and *Sargassum* have been used by different researchers on various crops and vegetables to assess their impact (Shahbazi et al. 2015). Specific concentrations of SLF made with above macroalgae have shown remarkable effect with respect to growth, productivity of crops and vegetables like *Vigna radiata*, *Abelmoschus esculentus, Phaesolus Vulgaris*, *Vigna mungo* (Divya et al. 2015, Latique et al.2013, Selvam et al. 2013). In future they may emerge as one of the most potential, non conventional form of biofertilizer for various crop plants. present in seawee The concentration of minerals, vitamins, proteins, carbohydrates and lipids is relatively high in many macro algae. They are known to have soluble potash, and plant growth hormones which make them an efficient stimulator and growth promoter(Divya et al. 2015). That is the reason they act as biostimulant and play a significant role in enhancing the yield of vegetables and crops.

In this piece of research investigation effect of SLF prepared from two seaweeds, namely *Cadophora* sp. and *Gracilaria* sp. has been studied on the germination index of *Triticum aestivum* Linn. by petriplates and pot sowing methods. In addition to this, their effect on morphological parameters and chlorophyll content has also been assessed at young seedling and eight days old stage of plants.

MATERIALS AND METHODS:

Collection of sample:

Samples of the macroalgae *Cladophora* and *Gracilaria* were collected from Bandra bandstand coastal area in Mumbai. The handpicked samples were properly washed in the laboratory to remove the sand particles and other undesirable debris. The specimens were observed under the compound microscope for proper identification.

Seaweed liquid fertilizer preparation

After washing and proper identification, the samples were spreaded on the blotting paper sheet and dried at room temperature in the shade initially and then in oven at 37^0 C. Dry samples were powdered and used for preparation of SLF as per the method given by Ramarao (1990). One gm of the sample was dissolved in 20 ml of distilled water and subjected to sterilization in autoclave at 15 lb (120^0 C). The mixture was brought to room temperature and filtered. It was thereafter used as stock solution for preparing 5%, 10%, and 15% dilutions used in the present studies.

SLF treatment of seeds

Seeds of *Triticum aestivum* were soaked in 5%, 10%, and 15% SLF solutions and control for duration of 12 hours. These seeds were thereafter sown in following two sets of triplicate each.

(i) Petriplates lined with wet blotting paper- Germination index was recorded. In addition to this morphological parameters (root and shoot length, no of roots) were recorded for 72 hr old seedlings raised in the petriplates.

(ii) Plastic pots having garden soil- germination index was recorded. Seedlings were tended till eight days. They were then harvested and their morphological parameters were recorded. Biomass in term of fresh weight and chlorophyll content were also estimated.

Biomass and chlorophyll estimation

Eight days old plants were uprooted, soil particles were removed by washing the roots thoroughly in tap water. They were dabbed in blotting sheets to remove the traces of extra water and thereafter their fresh weight was recorded. For total chlorophyll estimation Arnon's (1949) method was followed.

RESULTS:

In the present piece of research work, the effect of SLF prepared with macroalgae *Cladophora* and *Gracilaria* spp was studied on *Triticum aestivum* in following two sets of experiment-

1. Seventy two hrs after germination in the petriplates.
2. Eight days after sowing in the plastic pots containing garden soil.

1. Seventy two hrs after germination in the petriplates

Seed germination index, average number of roots, average length of roots and shoots were the parameters recorded in young seedlings post 72 hrs germination. Germination index which was recorded to be only 70% in control, increased with increasing concentrations of SLF in case of *Cladophora*. It was 100% after 15% *Cladophora* SLF treatment (Table 1). Similar results, i.e., 100% germination index were recorded in case of 5% and 10% *Gracillaria* SLF treatment. However, it dropped to 95% when the seeds were treated with 15% of *Gracillaria* SLF. This perhaps indicates that the concentration of SLF beyond a certain level has a limiting effect on the germination index of *Triticum aestivum*. Average number of root branches of the 72 hrs old seedlings did not show much variation, it was recorded to be either four or five after treatments with *Cladophora* as well as as *Gracillaria* SLF. However average root and shoot length exhibited much variation. Average root and shoot length of 72 hours old seedlings were recorded to be higher in 10% *Cladophora* SLF treatment (Table 1). A different pattern was observed in *Gracillaria* SLF treated seedlings. Root and shoot lengths were highest in 5% *Gracilaria* treated treated seedlings. A comparison of above two SLF treatments clearly indicates that 5% SLF made with *Gracillaria* is more effective in terms of seed germination index, root and shoot length (Histogram I).

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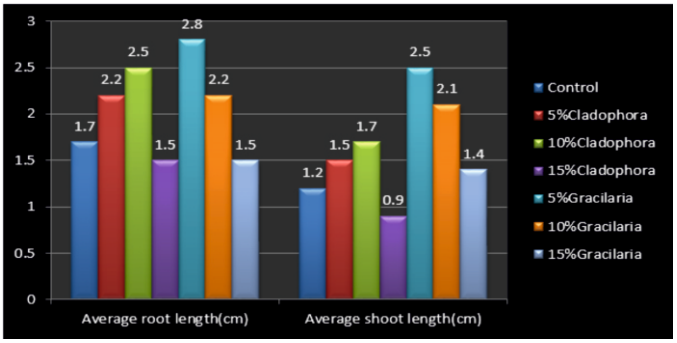
Table I. Germination Index, root number, root length and shoot length of 72 hrs old seedlings cultured by petriplates method

Parameters studied	Control	SLF treatment					
		Cladophora			*Gracillaria*		
		5%	10%	15%	5%	10%	15%
Seed germination index	70%	88%	92%	100%	100%	100%	95%
Average no of roots	5	4	5	5	5	5	4
Average root length	1.7	2.2	2.5	1.5	2.8	2.2	1.5
Average shoot length	1.2	1.5	1.7	0.9	2.5	2.1	1.4

Histogram I. Comparative analysis of average root length and shoot length of 72 hrs old seedlings cultured by petriplates method



2. Eight days after sowing in the plastic pots containing garden soil

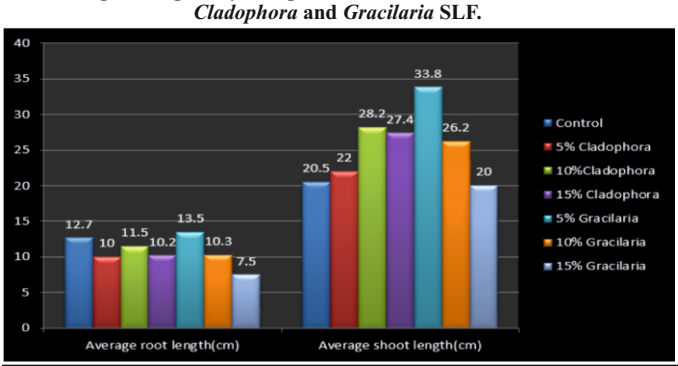
In another set of experiment, *Triticum* seeds treated with similar strengths of *Cladophora* and *Gracilaria* SLF were sown in plastic pot containing garden soil. Germination index was recorded and eight days old seedlings were harvested to study morphological parameters mainly, root length, and shoot length; and biomass in terms of fresh weight. Their total chlorophyll content was also measured. Germination index was found to be only 70% in control (untreated seeds) as compared to 100% in 15% *Cladophora* SLF, and 5% and 10% *Gracilaria* SLF treated seeds. Average root length, average shoot length, fresh weight biomass, and primary productivity in terms of tot al chlorophyll in case of *Cladophora* treatment were found to be maximum in seedlings grown from 10% treated *Cladophora* SLF. However in case of *Gracilaria* SLF treatment these parameters were found to be higher in 5% SLF treated seedlings.

Table II. Germination Index, , root and shoot length, fresh weight and total chlorophyll of 8 days old seedlings cultivated in pots.

Parameters studied	Control	SLF treatment					
		Cladophora			*Gracillaria*		
		5%	10%	15%	5%	10%	15%
Seed germination index	70%	88%	92%	100%	100%	100%	95%
Average root length (cm)	12.7	10.0	11.0	10.2	13.5	10.3	7.5
Average shoot length(cm)	20.5	22.0	28.2	27.4	33.8	26.2	20.0
Fresh weight (gm)	0.7	0.9	1.0	1.0	1.4	1.2	0.9
Total chlorophyll (mg/gm)	0.26	0.32	0.44	0.31	0.54	0.44	0.38

Biomass on fresh weight basis was found to be maximum in 5% *Gracilaria* SLF treated seedlings, followed by 10% *Cladophora* SLF treated seedlings of *Triticum aestivum*. Almost similar pattern was seen in total chlorophyll content. It was recorded to be highest in 5% Gracilaria SLF treated seedlings (0.54mg/gm), followed by 10% *Cladophora* as well as 10% *Gracilaria* SLF treated seedlings (0.44mg/gm). It was found to be quite low in seedings raised with control untreated seeds (Table II).

Histogram II. Comparative analysis of average root length and average shoot length of eight days old plants cultivated from seeds treated with *Cladophora* and *Gracilaria* SLF.



DISCUSSION:

In the present piece of research work, seed germination index was found to be only 70 % in control. After treatment with *Cladophora* SLF, it increased with increasing SLF percentage, reaching to 100% in case of 15% *Cladophora* SLF. With 5% and 10% *Gracilaria* SLF treatment also the germination index increased to 100%. However, with 15% *Gracilaria* SLF treatment it decreased slightly to 95%. Effect of SLF on *T. aestivum* has previously been studied by Shahbazi et al. (2015). They also reported an increase in the germination rate of SLF treated seeds as compared to the control. In *Cajanus cajan* (Kalaivanan et al., 2012) and *Lycopersicon* spp. (Alalwani et al., 2012) also similar pattern of germination were recorded. According to Gupta (2012) the reason behind this may be the occurrence of IAA and IBA, Gibberellins (A&B), cytokinins in SLF.

Almost similar results were found in in *Abelmoschus esculentus* by Arun et al. (2014) where seeds treated with 10% *Sargassum myryocystem* SLF showed higher germination index. But the concentrations higher than this reduced the germination index.

Comparative analysis of average root and average shoot length of wheat seedlings in the present work exhibited that these parameters were maximum in plantlets cultivated with seeds treated with 5% *Gracilaria* SLF as shown in the histogram II.

Arun et al. (2014) further reported that in *Abelmoschus esculentus,* comparatively lower concentrations of SLF prepared with *Dictyota dichotoma* played a significant role in enhancing the root and shoot growth and also the number of roots. Higher concentrations of SLF prepared both from and *Dictyota dichotoma* and *Sargassum myryocystem* were not much effective in inducing germination. This indicates that these higher concentrations of SLF might have a negative impact on growth parameters as well.

Divya et al. (2015) studied the effect of *Sargassum wightii* seaweed liquid fertilizer on the growth and productivity of Brinjal. They applied 5% and 10% of SLF and found that not only the germination index but the fresh weight, dry weight, number of leaves, flowers, root and shoot length were also maximum in low concentration of SLF, i.e., 5% as compared to control and 10% SLF treated seeds. Number of fruits and freish fruit weight also exhibited the similar pattern.

Divya et al. (2015) analyzed the physicochemical properties of the SLF prepared with seaweed *Sargassum wightii.* They found presence of multiple macro nutrients in it such as calcium, magnesium, nitrogen, phosphorus, potassium, and also the micro nutrients such as iron, manganese, zinc, copper. In addition to these cytokinin, and auxin growth hormones were present in noticeable amounts. A specific low concentrations of these substances might be acting as stimulant and promoter for growth and yield of of plants.while at high concentrations these might be inhibiting these parameters.

Kalaivanan et al. (2012) showed that treatment of *Vigna mungo seeds* with lower concentration of *C. scalpelliformis* (25%) SLF has increased amylase activities in leaves of *Vigna mungo.*

It was found that the seed treatment at low concentration not only promoted germination percent, shoot and root length but the chlorophyll and carotenoid content also increased. Similar pattern has been reported in many other economically important crop plants also the lower concentration of SLF is reported to give better results, or instance, *Abelmoscus esculentus* (Sasikumar *et al*., 2011), *Brassica nigra* (Kalidass *et al*., 2010), *Cajanus cajan* (Erulan *et al*., 2009), *Dolichos biflorus* (Anantharaj and Venkatesalu, 2002),), *Vigna sinensis* (Sivasankari *et al*., 2006c), *Vigna catajung* (Anantharaj and Venkatesalu, 2001) and *Vigna unguiculata* (Sekaram *et al.*, 1995).

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